DOCUMENT RESUME

ED 025 900 EF 001 891

Diatomite Type Filters for Swimming Pools. Standard No. 9, Revised October, 1966.
National Sanitation Foundation, Ann Arbor, Mich.
Pub Date Oct 66
Note-37p.
Available from-National Sanitation Foundation, Ann Arbor, Michigan ($1.00)
EDRS Price MF-$0.25 HC-$1.95
Descriptors-*Building Equipment, *Equipment Standards, Public Health, *Sanitation, *Swimming Pools

Pressure and vacuum diatomite type filters are covered in this standard. The filters herein described are intended to be designed and used specifically for swimming pool water filtration, both public and residential. Included are the basic components which are a necessary part of the diatomite type filter such as filter housing, element supports, filter septa, mechanical cleaning devices and other similar accessories. Not included in this standard are filters which do not use a filter aid such as diatomaceous earth, processed perlite or similar material. Included in this standard are--(1) minimum requirements, (2) definitions, (3) materials, and (4) design and construction. A final section discussed recommendations for installation and operation. (RH)

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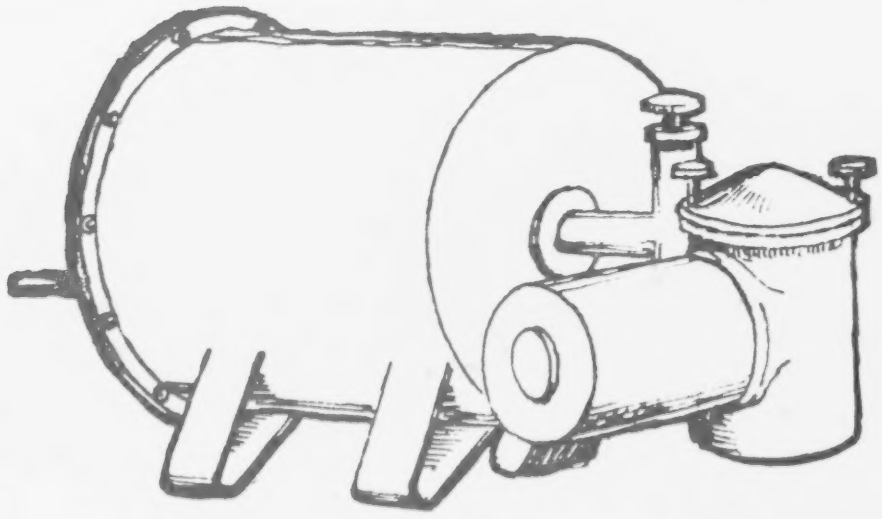
NATIONAL SANITATION FOUNDATION

STANDARDS



DIATOMITE TYPE FILTERS
for
SWIMMING POOLS

EF001891

Standard Number **9**

PREPARED BY THE NATIONAL SANITATION FOUNDATION
COMMITTEE ON SWIMMING POOL EQUIPMENT STANDARDS

SEAL OF APPROVAL

To identify equipment that has met
NSF Standards & Criteria
(Colors: blue, gray and white.)

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION

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NATIONAL SANITATION FOUNDATION

STANDARD No. 9

Relating to

DIATOMITE TYPE FILTERS

for

SWIMMING POOLS

Prepared by the

NATIONAL SANITATION FOUNDATION COMMITTEE

ON

SWIMMING POOL EQUIPMENT STANDARDS

Adopted December 1960

Printed as Revised

October 1966

THE NATIONAL SANITATION FOUNDATION
Ann Arbor, Michigan
Price $1.00

This is one of a series of nationally uniform sanitation standards and criteria established by the National Sanitation Foundation.

Current Standards and Criteria include:

No. 1 Soda Fountain and Luncheonette Equipment
No. 2 Food Service Equipment
No. 3 Spray-Type Dishwashing Machines
No. 4 Commercial Cooking and Warming Equipment
No. 5 Commercial Hot Water Generating Equipment
No. 6 Dispensing Freezers
No. 7 Commercial Refrigerators and Storage Freezers
No. 8 Commercial Powered Food Preparation Equipment
No. 9 Diatomite Type Filters for Swimming Pools
No. 10 Sand Type Filters for Swimming Pools
No. 11 Recessed Automatic Surface Skimmers
No. 12 Automatic Ice Making Equipment
No. 14 Thermoplastic Materials, Pipe, Fittings, Valves and Joining Materials
No. 15 Thermoset Plastic Pipe, Fittings, Valves, Tanks, Appurtenances, Joining Materials, & Thermoset Plastic Coatings for Use in Potable Water Supply Systems
No. 16 Film Badge Services
No. 17 Centrifugal Pumps for Swimming Pools
No. 18 Manual Food and Beverage Dispensing Equipment
No. 19 Chemical Feeders for Swimming Pools
No. 20 Bulk Milk Dispensers
No. 21 Thermoplastic Refuse Containers
C-1 Food Vending Machines
C-2 The Evaluation of Special Equipment and/or Devices
C-4 Reinforced Plastic Tanks
C-5 Cartridge Type Drinking Water Filters
C-6 Cloth Towel Dispensers
C-7 Plastic Lined Asbestos-Cement Pipe
C-8 Pitless Well Adapters

The National Sanitation Foundation

PURPOSE

IN 1944 A SMALL GROUP of industrial and public health leaders were discussing mutual problems involving sanitation. They realized that modern sanitation problems affecting industry and the public health could better be solved through mutual understanding and cooperative action to produce sound, effective educational programs and to foster public knowledge, rather than through ordinances, inspections and law enforcement alone.

It occurred to them that great strides could result from the creation of an independent but authoritative liaison organization which would be a clearing house through which business, industry and health authorities could work together for the solution of common problems and for the common good.

They realized that through such an organization they could foster the research and educational programs so essential to keeping abreast of the technological advances of industry, with modern products and services, and with the daily lives of the people.

Thus was born the National Sanitation Foundation with Headquarters in the School of Public Health of the University of Michigan at Ann Arbor, Michigan.

The National Sanitation Foundation is a non-commercial, non-profit organization seeking solutions to all problems involving cleanliness and sanitation. It is dedicated to the prevention of illness, the promotion of health and the enrichment of the quality of American living through preplanning of preventative programs for the improvement of the environment.

The National Sanitation Foundation fulfills the important purpose of arranging for a common meeting ground where industry and public health may discuss and solve common problems.

PROGRAM

The program of the National Sanitation Foundation (started in 1948 at the National Sanitation Clinic by some 500 of the nation's leading public health authorities, businessmen and industrialists) encompasses five basic areas of activity:

BASIC AND APPLIED RESEARCH: The need for an enlarged research program in the field of environment was recognized by

the Clinic as pressing. Many problems and uncertainties are currently answered by a multiplicity of curbstone opinion. Only through seeking out and defining the answers thereto, can sanitation attain the status it deserves.

STANDARDS: The need for uniform equipment standards was pointed out by both industry and public health groups. Numerous National Sanitation Foundation Standards have been developed, and additional Standards are in various stages of completion. These Standards, based on scientific fact, have been developed on a cooperative basis by representatives of industry and professional public health officials and are the result of comprehensive study and review by all concerned groups.

TESTING LABORATORY: The need for an independent testing laboratory where applied research relative to sanitation methods, materials and equipment could be conducted objectively had been expressed many times by industry and public health. The 1948 Clinic emphasized that such a laboratory where tests may be made and, when merited, approval given would serve as a valuable contribution to the improvement of environment throughout the country. The National Sanitation Foundation Testing Laboratory was established in 1952 to fulfill this need and serves both industry and public health sanitation interests.

SEAL OF APPROVAL: A Seal of Approval, or some means of identifying items of equipment or devices meeting high public health standards, was specified by the Clinic to be an urgent need. Following the establishment of the National Sanitation Foundation Testing Laboratory, an official Seal of Approval was adopted and may be authorized for use by industry on equipment found to conform with National Sanitation Foundation Standards. A continuing program of evaluation for equipment, devices or products authorized to bear the Seal was implemented and annual renewal of such authorization is required.

EDUCATION: Only through an adequate program of education is it possible to translate the results of research to health officials, business and the public. Several programs have been established for the expressed purpose of implementing and conducting basic and applied research activities in the fields of education, methodology, working relationships and communications between the public, industry, academic interests, professional public health workers and official agencies.

PREFACE

This Standard, covering Diatomite Type Filters, is the first in a series of NSF Standards for Swimming Pool Equipment. These Standards are being developed and issued in recognition of the need for a common understanding of the problems of sanitation involving industry and administrative health officials whose obligation it is to enforce regulations.

These Standards are the result of considerable study on the part of public health officials, consultations with technical representatives of industry, and investigations by the National Sanitation Foundation's staff. The improvement of environmental health and sanitation and the establishment of uniform requirements have been the primary aim in the preparation of these Standards. However, it is recognized that continued technological progress will require periodic changes.

The adoption of these Standards offers health officials an opportunity to present a united front in securing the basic equipment necessary for the safe and efficient operation of swimming pools, private or public. It gives users of such equipment the assurance of meeting health standards and of satisfactory performance when properly operated. Also, NSF Standards give manufacturers the advantage of applying uniform design and construction methods with confidence that equipment conscientiously built to meet said Standards will be generally acceptable.

Finally, as an aid to all concerned in recognizing approved equipment, the National Sanitation Foundation Testing Laboratory has established a program under which the use of its insigne, nSf, can be authorized on filters that meet the requirements herein established for Diatomite Type Filters for Swimming Pools.

Permission to use the National Sanitation Foundation Testing Laboratory's Seal of Approval is granted only after evaluation of the applicant's manufacturing methods and performance testing of his filters shows compliance with the Standard. Continuance of authorization to use the nSf Seal of Approval is dependent upon evidence of compliance with the Standard through periodic re-evaluation of equipment in factory and field.

Sincere appreciation is extended to all members of the Committees herein listed who so willingly devoted their time to the development of this and other Standards. Special credit and thanks are due the members of the Sub-Committee for Diatomite Type Filters and of the

NSF Committee on Swimming Pool Equipment Standards for the long hours spent in review, discussion and correspondence as well as to the Industry Advisory Committee for its untiring efforts in this work.

Henry F. Vaughan, Dr. P.H., President
National Sanitation Foundation

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EQUIPMENT STANDARDS

SUGGESTIONS CONCERNING REGULATIONS GOVERNING DIATOMITE TYPE FILTERS FOR SWIMMING POOLS

It is strongly recommended that these Standards, representing a cross-section of opinion of workers in the field of environmental health, be accepted and followed by enforcement officials. However, their incorporation in detail into local sanitary codes does not appear to be necessary and is likely to be cumbersome.

In municipalities, counties, and health districts in which the adoption of legislation by reference is considered legal, the following regulation should serve to implement the use of this Standard for Diatmite Type Filters:

> ALL DIATOMITE TYPE FILTERS INSTALLED ON OR AFTER _____IN PUBLIC OR PRIVATE SWIMMING POOLS IN THIS JURISDICTION SHALL MEET THE NATIONAL SANITATION FOUNDAION STANDARDS FOR SUCH EQIUPMENT.

Or, if considered desirable, it will be simpler to adopt the following more general regulation applying to all NSF Standards in the swimming pool equipment field:

> ALL SWIMMING POOL EQUIPMENT INSTALLED ON OR AFTER_____FOR USE IN PUBLIC OR PRIVATE SWIMMING POOLS IN THIS JURISDICTION SHALL MEET THE APPLICABLE NATIONAL SANITATION FOUNDATION STANDARDS.

In fact, the adoption of this broad regulation will save time as well as advertising and printing costs as, no doubt, many different standards will be adopted. Otherwise, each standard will require the adoption of a specific regulation.

Wherever the legality of adopting legislation by reference is not recognized, delete the portion of either of the above regulations after the word "SHALL" and substitute therefor the words "BE OF A TYPE APPROVED BY THE HEALTH OFFICER." The health officer may be guided by the National Sanitation Foundation Standards in his approval of types.

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INTRODUCTION

The National Swimming Pool Institute was chartered in 1956 to raise the performance levels of the pool industry. The forward thinking members of the Institute very quickly recognized the need for developing standards for the variety of equipment then being marketed throughout the country. From a series of conferences between The National Sanitation Foundation and some of those early members of the Institute, the NSF Swimming Pool Equipment Evaluation-Listing Program was born.

The National Swimming Pool Institute is a trade association of firms at all levels of the industry—manufacturers, distributors, pool builders, maintenance firms, architects and so forth. As part of its mission to elevate the performance and image of the swimming pool industry through technical and management education, communications, strong ethics procedures and organizational development, the Institute has been a strong advocate of meaningful pool equipment standards and testing based on those standards.

The Institute promotes the development of equipment standards through appropriate product-oriented technical subcommittees, the NSPI Technical Council and the NSF Committee on Swimming Pool Equipment Standards. NSPI urges its members to seek the evaluation and Listing of equipment and solidly upholds the program before all its publics, both private and governmental.

The National Sanitation Foundation

STANDARD NO. 9

Relating To

DIATOMITE TYPE FILTERS

for

SWIMMING POOLS

Section 1. GENERAL

1.00 SCOPE. Pressure and vacuum diatomite type filters are covered in this Standard. The filters herein described are intended to be designed and used specifically for swimming pool water filtration, both public and residential. Included are the basic components which are a necessary part of the diatomite type filter such as filter housing, element supports, filter septa, mechanical cleaning devices and other similar accessories.

Not included in this Standard are filters which do not use a filter aid such as diatomaceous earth, processed perlite or similar material. These are generally referred to as cartridge or bag-type filters.

1.01 MINIMUM REQUIREMENTS: This Standard is established as a guide to the evaluation of the equipment covered herein, and the requirements are considered to be basic and minimum. Variations are permissable when they tend to make the equipment more resistant to corrosion, wear and physical damage, or if they improve the general operation and performance of the device. Variations shall be approved prior to their use.

1.02 ALTERNATE MATERIALS: Where specific materials are mentioned, it is understood that the use of other materials proven to be equally satisfactory for the intended end use will be acceptable.

1.03 REVIEWS AND REVISIONS: Following adoption of this Standard, and prior to its printed publication, a general review shall be carried out by the National Sanitation Foundation Committee on Swimming Pool Equipment Standards to ascertain if additional requirements are indicated. Subsequent to the printed publication of this Standard, a complete review of the Standard shall be conducted at intervals of not more than three years to determine what changes, deletions or additions,

if any, are necessary to maintain current and effective requirements consistent with new technology and progress. These reviews shall be conducted by appropriate representatives from the public health, industry and user groups. Final adoption of any revision shall be in accordance with the procedures established by the NSF Committee on Swimming Pool Equipment Standards.

1.04 VARIATIONS IN DESIGN AND OPERATION: A diatomite type filter varying in principle of design and/or operation from those set forth herein may qualify under the provisions of this Standard provided appropriate tests and investigations indicate that said filter produces filter cycles, performance, operation and service at least equivalent to those produced by equipment complying with this Standard. Such filters shall meet the requirements for materials, finishes and construction in this Standard.

Section 2. DEFINITIONS

2.00 ACCESSIBLE: Accessible shall mean readily exposed for proper and thorough cleaning and inspection with the use of only simple tools, such as a screw driver, pliers or wrench.

2.01 AGITATION: The mechanical or manual movement to dislodge the filter aid and dirt from the filter element.

2.02 AIR BUMP ASSIST BACKWASH: The compressing of a volume of air in the filter effluent chamber (by means of an air compressor or by the water pressure from the recirculating pump) which, when released, rapidly decompresses and forces water in the filter chamber through the elements in reverse, dislodges the filter aid and accumulated dirt and carries it to waste.

2.03 APPROVED: Found acceptable for the specific use as determined by the National Sanitation Foundation when related to the use of the nSf Seal of Approval.

2.04 BACKWASH: The passage of water at a sufficiently high velocity through the filter element in the reverse direction to dislodge the accumulated dirt and filter aid and to remove it from the filter tank or chamber.

2.05 BODY FEED: The continuous addition of controlled amounts of filter aid during the operation of a diatomite type filter to maintain a permeable filter cake. If added as a slurry, this is often referred to as SLURRY FEED.

2.06 DESIGN FLOW RATE: The flow rate in gallons per minute of a specific filter determined by multiplying the total effective filter area by the allowable flow rate per square foot (Filtration Rate).

2.07 EFFECTIVE FILTER AREA: The effective filter area of the septum shall be that part of the septum which will accept the full thickness of precoat and through which the design filter flow will be maintained during filtration.

2.08 FILTER AID: A type of finely divided medium used to coat a septum type filter; usually diatomaceous earth, processed perlite or similar material.

2.09 FILTER CYCLE: The operating time between filter cleanings (sometimes referred to as filter run).

2.10 FILTER, DIATOMITE TYPE: A device designed to filter water through a thin layer of filter aid such as diatomaceous earth, processed perlite or similar material. Diatomite filters may be of the pressure or vacuum type.

2.11 FILTER ELEMENT: A device within a filter tank designed to entrap solids and conduct water to a manifold, collection header, pipe or similar conduit. Filter elements usually consist of a septum and septum support.

2.12 FILTER, VACUUM: (or Suction) A filter which operates under a vacuum from the suction of a pump.

2.13 FILTRATION RATE: The rate of filtration of water through a filter during the filter cycle expressed in gallons per minute per square foot of effective filter area.

2.14 FRESH WATER: Those waters having a specific conductivity less than a solution containing 6000 ppm of Sodium Chloride.

2.15 PRECOAT: The coating of filter aid on the septum of a diatomite type filter at the beginning of each filter cycle.

2.16 REMOVABLE: Capable of being taken away from the main unit with the use of only simple tools, such as screw driver, pliers or open-end wrench.

2.17 SALINE WATER: Those waters having a specific conductivity in excess of a solution containing 6000 ppm of Sodium Chloride.

2.18 SEPTUM: That part of the filter element consisting of cloth, wire screen or other porous material on which the filter medium or aid is deposited.

2.19 SPRAY RINSE, MECHANICAL: A fixed or mechanically movable spray system which directs a stream of water against the filter surface, causing the filter aid and accumulated dirt to dislodge into the empty tank.

2.20 SPRAY RINSE, MANUAL: Manually washing the filter aid and dirt from the filtering surface, either in place or after removal from the filter tank or chamber. This is usually accomplished by means of a hose and nozzle.

2.21 TOXIC: The word "toxic" shall refer to the adverse physiological effect to man.

2.22 TURNOVER: The period of time, usually in hours, required to circulate through the filter system a volume of water equal to the pool capacity.

Section 3. MATERIALS

3.00 GENERAL: Any suitable material may be employed that will withstand normal handling and shipping and which will meet the requirements of corrosion resistance and pressure as outlined herein. The material shall be safe and shall not produce any toxic effect or impart undesirable tastes, odors or colors to the pool water.

In saline water applications, special consideration shall be given to selection of materials which are corrosion resistant under saline conditions, or a properly applied and adequate protective corrosion resistant coating shall be used on all wetted surfaces.

3.01 CORROSION RESISTANT MATERIALS: Corrosion resistant materials will be accepted without coating of wetted surfaces. The following is a list of presently accepted materials: (1) approved copper alloys (including bronze and brass), (2) AISI type 300 series stainless steel, (3) monel, (4) approved synthetic (plastic) materials, (5) approved concrete.

3.02 NON-CORROSION RESISTANT MATERIALS: Non-corrosion resistant materials shall be provided with a properly applied adequate protective coating completely covering all wetted surfaces. Cathodic protection may be included as an additional means of preventing or reducing corrosion.

3.03 DISSIMILAR METALS: Dissimilar metals not normally considered compatible on the electromotive scale shall not be in direct contact in the filter construction.

3.04 INSULATING FITTINGS: Insulating fittings shall be provided

when face piping material is not compatible on the electromotive scale with the material of the filter tank. Such fittings shall be electrically non-conductive and of a material meeting the other requirements of this Standard (Item 3.00).

3.05 PIPING MATERIALS, FRESH WATER APPLICATIONS: For fresh water applications, galvanized steel or iron pipe with cast or malleable iron fittings and bronze or iron bodied bronze fitted valves may be used in filter external or face piping without protective coating as a permissible deviation to the materials specified in Item 3.01 of this section. When such materials are used in the face piping with a steel filter tank, no insulating fittings shall be required; but if the tank is of a metal dissimilar to the piping, insulating fittings between the two shall be provded.

3.06 PIPING MATERIALS, SALINE WATER APPLICATIONS: Piping for saline water applications shall be of the following corrosion resistant materials:

Aluminum brass*
90-10 cupro-nickel
70-30 cupro-nickel
Monel Alloy 400
Approved PVC, ABS and Polyethylene plastics

* Should not be used where velocities are in excess of 8 FPS.

Alternate materials may be approved under the provisions of Item 1.02 of this Standard.

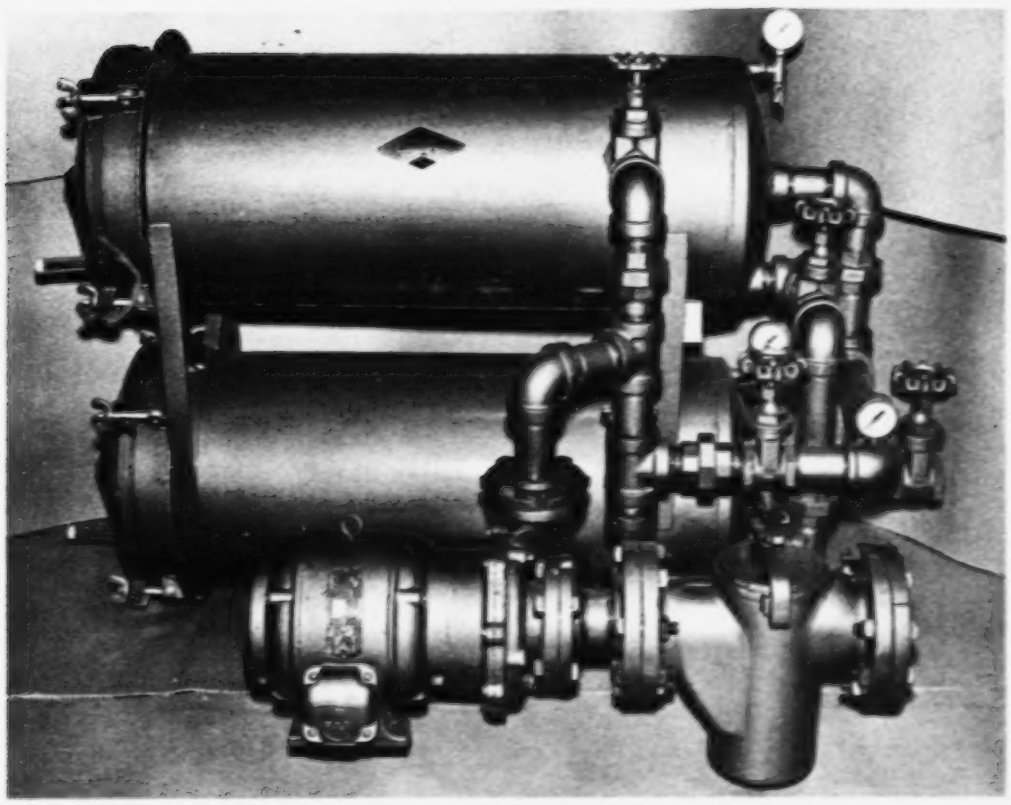
Horizontal Spin-Type Pressure Diatomite Filter

Section 4. DESIGN AND CONSTRUCTION

4.00 FILTER TANKS, PRESSURE SERVICE:

4.001 WORKING PRESSURE: Tanks shall be designed for a minimum working pressure of 50 psi with a 4 to 1 safety factor. When the maximum shut-off head of the pump used with the filter tank exceeds 50 psi, the tank shall be designed for this head with a 4 to 1 safety factor. The manufacturer shall furnish design calculations indicating burst pressures of at least 200 psi.

4.0011 PRESSURE TEST: Tank shall be tested for soundness and leakage at a pressure of 150% of the working pressure in Item 4.001.



Commercial Multiple-Unit Horizontal Pressure-Type Diatomite

4.002 FILTER PIPING: All piping which is an integral part of the filter unit shall comply with the design and construction requirements for water piping of the American Standard National Plumbing Code, ASA-A40.8-1955.

4.003 INITIAL PRESSURE DROP: The initial pressure drop through any filter operating at the design flow rate with the required precoat and measured between the filter tank inlet opening and the filter tank discharge opening shall not exceed 3 psi.

4.004 ACCESSIBILITY, OPERATIONAL AND REPAIR FACILITIES:

4.0041 ACCESSIBILITY, FILTER ELEMENTS AND TANKS: All filter elements and other components which require servicing shall be accessible and available for inspection and repair when installed according to manufacturer's instructions.

4.0042 DRAINAGE OF TANK: Provision shall be made for completely draining the tank.

4.01 FILTER TANKS, VACUUM SERVICE:

4.011 PRESSURE REQUIREMENTS: Filter tanks shall be designed to withstand pressure developed by the weight of the water contained therein with a safety factor of 1½. Filters that may be closed during part of their operating cycle shall, in addition, be designed to withstand the crushing pressure developed by a vacuum of 25 inches of mercury with a safety factor of 1½.

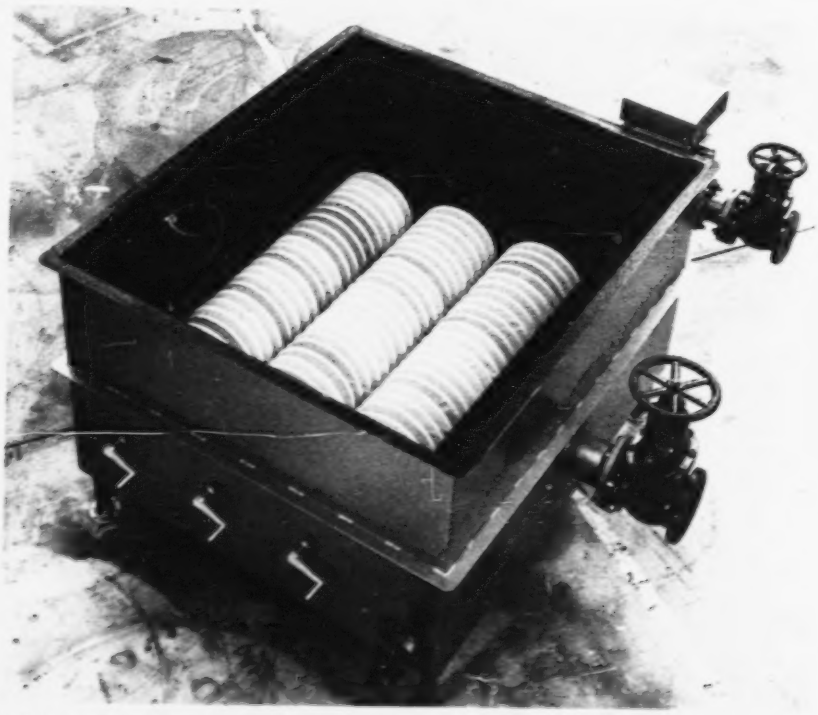
4.012 FILTER PIPING, INITIAL PRESSURE DROP, ACCESSIBILITY AND DRAINAGE: The requirements of Items 4.002, 4.003, 4.0041 and 4.0042 shall apply as for pressure filters.

4.02 INTERIOR COMPONENTS:

4.021 ELEMENTS:

4.0211 EFFECTIVE FILTER AREA: The actual area to be determined by measuring the effective area of the septum support during filtration. Septum support members shall not be considered as reducing the effective filter area provided the dimension of the cross-section does not exceed ¼ inch. For wire wound and similar elements,

the distance between members of a septum or between the adjacent openings shall not be greater than twice the thickness of the filter aid coat when 0.15 pounds of filter aid per square foot of effective filter surface is applied (For test purposes of this Standard, Johns-Mansville Celite 503, Grefco Inc. Dicalite Speedex, or Eagle Picher Colatom FW-20 shall be used). Septum supports shall maintain the septum in such a position as to prevent surface contacts which may impair filtration flow. Where bridging of filter aid may occur, only the final exposed, or effective, filtration surface produced will be considered as effective filter area.

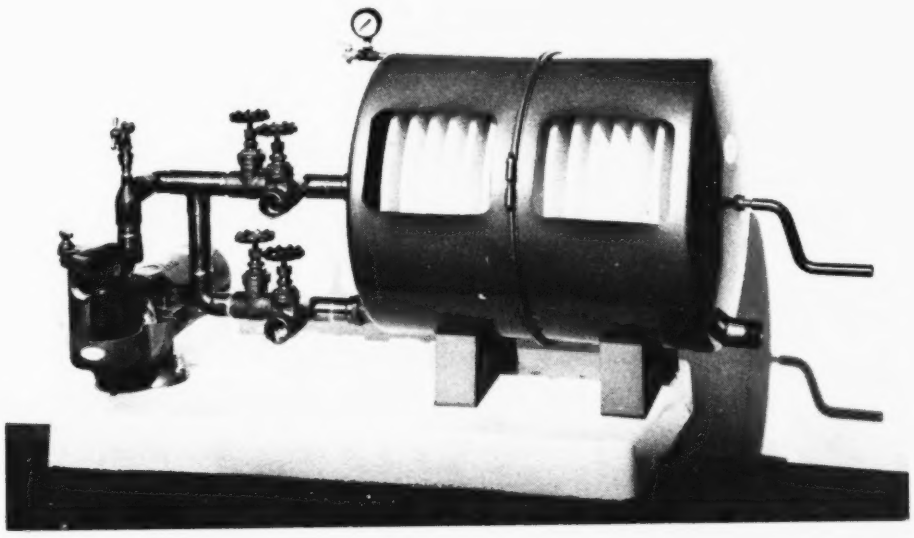


Vacuum Diatomite-Type Filter with Circular Filter Elements

4.0212 STRUCTURAL STRENGTH: All components of the element shall be constructed to be adequately resistant to damage or deformation which may affect the flow characteristics under a maximum differential pressure between influent and effluent of not less than 75 psi for pressure units and 20 psi for vacuum units.

NOTE: Special consideration should be given to the structural strength of elements when the maximum pressure which can be developed by the circulating pump exceeds those specified above. Where units are de-

signed for pressure backwash, all components of the filter element shall be designed to withstand the pressure differential developed during the backwash operation without permanent damage or deformation.



Cutaway view of a Horizontal Combination Spin & Backwash Type Pressure Diatomite Filter with Integral Face Piping

4.0213 RESISTANCE TO DAMAGE AND WEAR: The element and element assembly shall be of such design and construction as to resist damage or wear to which the filter is subjected during normal handling, shipping, installation and recommended operation.

4.0214 TURBIDITY LIMITS, PRECOAT OPERATION: The equipment shall be so arranged that during the precoating the effluent is refiltered or disposed to waste without passing into the pool until the effluent is clear of suspended matter. An exception to this requirement for filter recirculation or disposal can be made if the filter septum is of such construction that no perceptible quantity of suspended matter is introduced into the pool when the effluent discharges therein. The quantity of suspended matter shall be determined in the following manner:

The filter septum, when tested at a filter rate of 2 gpm per square foot and using .15 pounds of the test filter aid

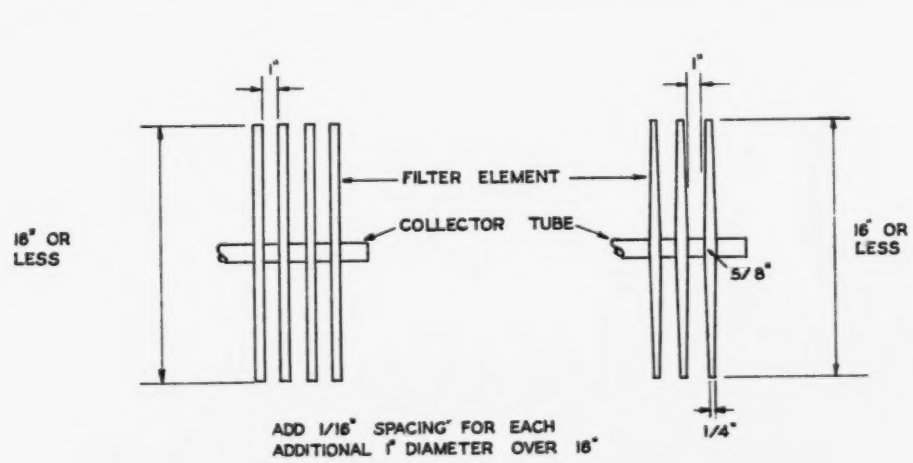
(see Item 4.0211) per square foot of filter area, shall not pass more filter aid than would produce an average turbidity in the effluent of 10 ppm during the first minute of flow.

4.0215 DESIGN SPACING: (A) Circular disc elements 16 inches or less in diameter shall be spaced not less than 1 inch apart. The spacing of circular disc elements over 16 inches in diameter shall be increased 1/16 inch for each additional inch in diameter.

(B) Leaf type elements, the average of the length and width of which is 16 inches or less, shall be spaced not less than 1 inch apart. Larger leaf type elements shall be increased in spacing in accordance with (A).

(C) Tube type elements shall have a minimum spacing of 1 inch except that flexible, expandable braided tube type elements need not comply with this requirement.

(D) Spacing shall in all cases be such as to prevent contact of septums during backwashing operations.



4.0215 DESIGN SPACING – CIRCULAR DISC ELEMENTS

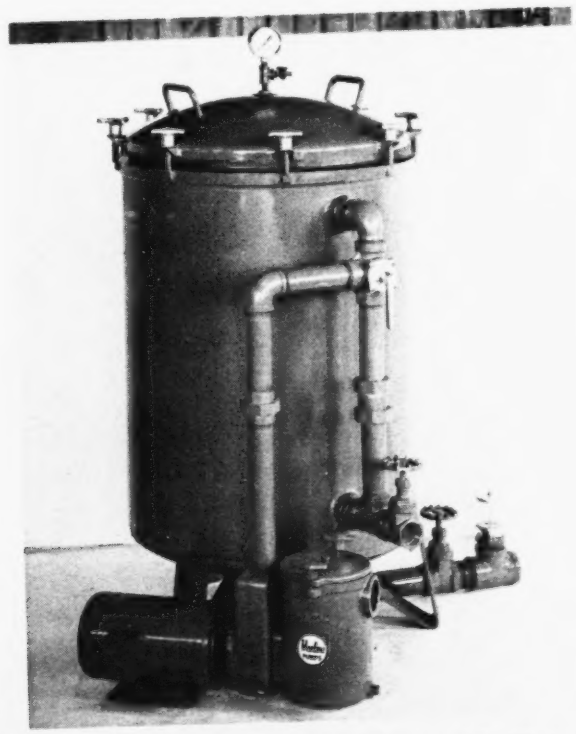
4.0216 OPERATION DISTORTION ALLOWANCE: Distortion of the elements under normal operation conditions shall not reduce the clear space requirements specified in 4.0215 by more than 25%.

4.022 INLET AND OUTLET WATER COLLECTING OR DISTRIBUTING DEVICES:

4.0221 BAFFLES: A suitable baffle, or other device, shall be installed in the filter tank to prevent the full flow of

incoming water from eroding the filter aid from the elements when in filtering operation.

4.0222 UNIFORM DISTRIBUTION, FILTER AID: The design and arrangement of the interior filter components shall be such as to provide for uniform distribution (± 50% of the average thickness) of the filter aid on the entire septum. Filters intended for intermittent operation during the filter cycle shall be designed and constructed to assure uniform distribution of the filter aid on resumption of use.



Vertical Pressure-Type Diatomite Filter with Face Piping and Multiport Valve

4.03 CLEANING OPERATION:

4.031 METHOD OF CLEANING: Cleaning must be accomplished by one or a combination of more than one of the following methods: Backwashing, air bump assist backwashing, spray wash (mechanical or manual) or agitation.

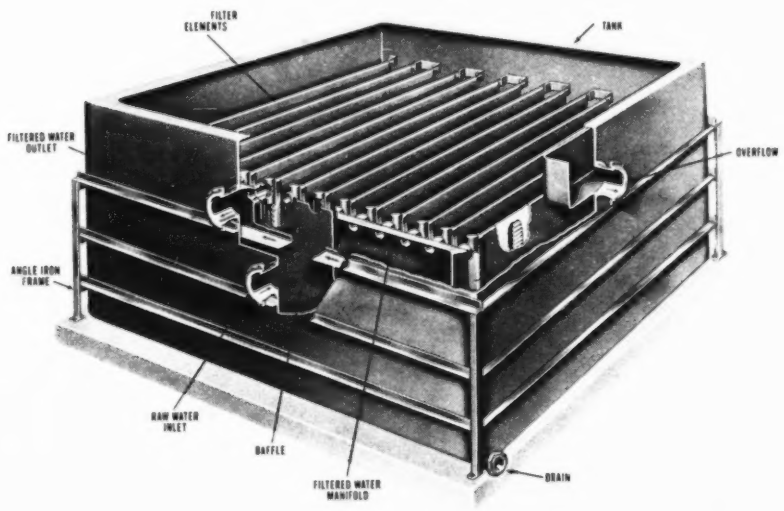
4.032 CLEANING INSTRUCTIONS:

4.0321 REQUIREMENTS FOR CLEANING: One or more of the methods of cleaning in Item 4.031 must satisfactorily

perform the function of removal of the filter aid and accumulated dirt from the filtering surfaces and filter septum and shall render the filter septum in as near its original permeability as is practical.*

4.0322 INSTRUCTIONS REQUIRED: The manufacturer shall clearly describe the cleaning procedures in printed instructions so that an operator unfamiliar with this particular piece of equipment will be able to perform the cleaning operation correctly.

4.0323 REMOVAL OF WASTE FROM FILTER TANK: Means shall be provided for the removal of the wash water, dislodged filter aid and dirt from the filter tank to prevent the accumulation of waste matter in the filter tank and connecting piping.



Cutaway View of Vacuum-Type Diatomite Filter

4.033 CLEANING EFFICIENCY:

4.0331 TIME REQUIRED: The cleaning operation shall not require an undue length of time or energy to perform, and the amount of water required to properly clean the filter shall not be excessive.

* For test purposes, the cleaning operation shall be performed exactly as recommended and instructed by the manufacturer using a water supply of adequate volume having a turbidity of not more than 5 ppm.

4.0332 PRESSURE DROP INCREASE: The increase in pressure drop through a filter between the initial and final test run shall not be perceptible.**

4.04 AIR RELEASE: Each pressure filter tank shall be equipped with an air release connected at the top of the tank that will expel air which enters the filter tank. A means shall be provided to permit the manual operation of the air release.

4.05 OPERATION INSTRUCTIONS AND DATA PLATE:

4.051 MANUAL: A manual of instructions shall be provided with each filter and shall include: drawings, photographs, written operating instructions, charts and parts lists sufficient to permit proper installation, operaion and maintenance of the particular model of filter involved. The manual shall also specify the amount, type and grade of filter aid recommended.

Vertical Pressure-Type Diatomite Filter without Face Piping

** The conditions of testing, as well as the minimum number of cycles necessary to simulate operating conditions, will be determined as data and test information becomes available.

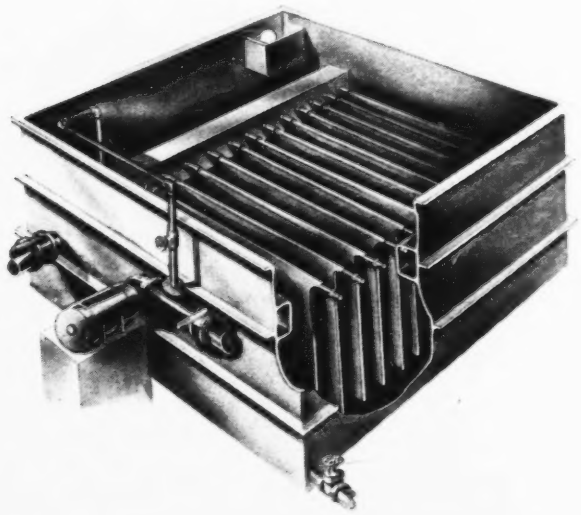
4.052 DATA PLATE:

4.0521 TYPE AND LOCATION: Data plates shall be of permanent nature, so inscribed as to be easily read and understood, and securely attached to the filter plant at a readily accessible location.

4.0522 CONTENTS: Data plates shall contain the following information:

(1) Manufacturer's name and address
(2) Filter model number
(3) Filter Serial Number
(4) Effective filter area in square feet
(5) Required clearance (vertical & Horizontal) for service and maintenance
(6) Design flow rate in GPM with and without slurry feed for private residential pools and/or public pools (See Item 4.07 and subsections)
(7) Maximum working pressure, if applicable
(8) Briefly stated, in order, the steps of operation
(9) The data plate shall indicate as to whether or not the unit has been tested for fresh water only, or for fresh water and saline water application

4.053 VALVE IDENTIFICATION: All valves shall have a permanent label or tag attached.



Vacuum Diatomite-Type Filter with Rectangular Filter Elements

Commercial Multiple-Unit Vertical Pressure-Type Diatomite Filter with Integral Face Piping

4.06 MECHANICAL OR MOVING PARTS:

NOTE: Material specifications are covered in Section 3. MATERIALS.

4.061 PIPING, VALVES AND FITTINGS: Pipe, valves and fittings shall be checked for correctness of use, thoroughness of fabrication and/or assembly and adequacy of support. When filters are supplied without required face pipings, valves and fittings, an approved piping diagram, parts list and installation procedure shall be provided by the manufacturer.

4.062 ASSEMBLY: Piping assembly shall be checked for adequacy of design to permit disassembly of component parts for maintenance and repair.

4.063 MOVING PARTS: Moving parts, other than manually operated valves, shall be checked and, where possible, tested on an accelerated basis to determine the theoretical life expectancy which shall be no less than 5 years.

4.064 CLOSING AND SEALING DEVICES: Mechanical clamps, gaskets, and tightening elements shall be checked for aptness of application and adequacy.

4.065 FUNCTION: The entire equipment and each component part shall be fully checked in actual operation to verify that the various functions are correctly and adequately performed. The manufacturer's instructions shall be carefully followed in this step-by-step operation. Functions referred to include face piping variations, precoating, filter cleaning, slurry agitation, slurry feeding, filtering, filter to waste, draining and air release.

4.07 DESIGN CRITERIA: Sufficient effective filter area shall be provided, (based on the criteria shown in item 4.071 and subsections) to conform to the following recommended Turn Overs:

a. Heavily used public-type pools—not more than 6 hours
b. Other public-type pools—not more than 8 hours
c. Residential pools—not more than 12 hours

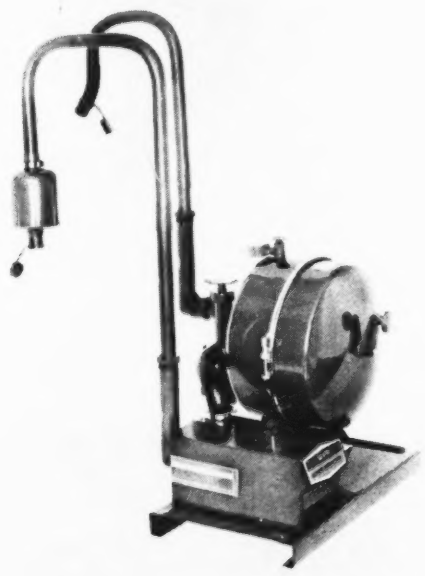
4.071 PRESSURE AND VACUUM FILTERS:

4.0711 Residential pools without slurry feed, 2½ GPM per square foot of filter area.

4.0712 Residential pools with slurry feed, 3 GPM per square foot of filter area.

4.0713 Public pools without slurry feed, 2 GPM per square foot of filter area.

4.0714 Public pools with slurry feed, 2½ GPM per square foot of filter area.



Spin-Type Pressure-Type Diatomite Filter for Above-Ground Pool

RECOMMENDATIONS FOR INSTALLATION AND OPERATION

The following is not a basic part of the Standard and as such is not the responsibility of the manufacturer. However, to obtain proper results the following limitations should be considered in the over-all hydraulic design of the pool. Diatomite type filters designed and constructed in accordance with this Standard will give satisfactory results the following limitations should be considered in the over-all circulating pump, piping and services and operated in accordance with the manufacturer's recommendations. The method of installation and operation should be in conformance with the manufacturer's recommendations and the applicable state and local laws and regulations.

A. RECOMMENDED INSTALLATION

I. TURNOVER: The turnover will vary depending upon classification of pool, bathing load and type of usage within the following ranges:
   a. Heavily used public-type pools—not more than 6 hours.
   b. Other public-type pools—not more than 8 hours.
   c. Residential pools—not more than 12 hours.

II. PUMPS:
   a. Pressure-Type Filters: Pressure-type filters require a pump capable of delivering the design flow rate at a minimum of 60 feet of head for public pools and a minimum of 45 feet for residential pools and at least 65% of that flow rate at an increase in head of 10 feet or more. In every case, the pump should be matched to the filter units.
   b. Vacuum-Type Filters: Vacuum-Type filters require a pump capable of delivering the design flow rate at a suction of at least 20 inches of mercury* without cavitation. There should also be sufficient reserve head to overcome the friction losses in the piping and appurtenances through which the water must flow after discharge from the pump in returning to the pool.

*Based on atmospheric pressure at sea level.

III. GAUGES AND RATE OF FLOW INDICATOR: An approved type pressure gauge (or gauges) with an appropriate range should be provided in connection with all filters. A rate of flow indicator with an appropriate range should be provided in connection with filters for public pools. A flow rate controller is recommended for installation in public pool systems.

IV. LOCATION: Filters should be so installed as to provide easy accessibility for cleaning, operation, maintenance and servicing. Tanks should be so positioned as to provide adequate circulation of air beneath and on all sides when necessary to reduce corrosion and to permit cleaning. When filters are installed in the ground (buried) they should be adequately protected against corrosion and installed in accordance with the manufacturer's recommendations.

V. MULTIPLE UNIT INSTALLATIONS: Where more than one filter is necessary to provide the rate of flow to satisfy the turnover specified, each filter unit should provide not less than 20% of this total rate of flow.

B. OPERATION AND MAINTENANCE

In order to obtain the ultimate in performance from any diatomite filter, there are several factors which must be taken into consideration and kept under control.

I. FILTER AID: The correct grade of filter aid is one of the most important factors in this regard. Too fine a material will do an excellent job of removing suspended particles, even down to the smallest size, but it will cause an undue shortening of the filter cycle. On the other hand, too coarse a grade of filter aid will permit small particles to pass through and, in the case of a small orifice septum, may cause them to become enmeshed in the septum where they are difficult to remove by the normal cleaning procedures. The grade of filter aid should be chosen consistent with the type and size of suspended matter being removed, the degree of clarity required, and the length of filter run desired.

II. FLOW RATE: The flow rate through any diatomite filter determines the total output of the filter. Too high a flow rate will invariably reduce filter runs disproportionately. The converse is true of lower filter rates. Optimum results may usually be obtained by maintaining flows of between 2 and 2½ gallons per minute per square foot of filter area. The use of slurry or body feeding may permit

an increase in this rate by breaking up or diluting the removed dirt particles.

III. ROUTINE CLEANING: Regular and thorough cleaning of the filter is necessary for the correct maintenance of a swimming pool, whether it be a public or residential one. This will result in labor-saving and in extended life of the equipment, as well as in correct water clarity.

The following points should be checked regularly:

a. Clean pump strainer and other strainers regularly, particularly before and after vacuum cleaning pool and before cleaning filter.
b. Lubricate pump and motor according to manufacturer's recommendations.
c. Keep pump shaft and valve stem packings in good condition.
d. Inspect filter elements and inside of filter tank at least once a season and make necessary repairs or adjustments.
e. Repair any leaks immediately.
f. Keep surfaces protected against corrosion by painting or cleaning regularly.
g. Clean filter regularly and thoroughly.
h. Inspect and clean air relief system regularly.

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SANITATION is a way of life. It is the quality of living that is expressed in the clean home, the clean farm, the clean business and industry, the clean neighborhood, the clean community. Being a way of life it must come from within the people; it is nourished by knowledge and grows as an obligation and an ideal in human relations.

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